AMENDMENTS TO THE CLAIMS

Please cancel Claims 1-5 without prejudice; amend Claims 6-17 and add new Claims 18-25 as follows.

LISTING OF CLAIMS

1.-5. (cancelled)

6. (currently amended) ~~A DC/DC converter, as set forth in claim 4,~~ A DC/DC converter comprising:

two main switches connected in series; and

a smoothing reactor one end of which is connected to the junction of the main switches; wherein

the two main switches are alternately turned on/off and at the same time, when a first main switch, which is one of the two main switches, is turned on, the electrical energy from a direct current power supply connected to the terminal on the input side is stored in the smoothing reactor, and when a second main switch, which is the other of the two main switches, is turned on, the electrical energy stored in the smoothing reactor is discharged to a load connected to the terminal on the output side;

an auxiliary resonance circuit, in which a resonance reactor and an auxiliary switch are connected in series, is comprised and at the same time a capacitive component is comprised in parallel to at least one of the two main switches,

when the auxiliary switch is on, the electrical energy is supplied from the terminal on the output side to the resonance reactor and the electrical energy stored

therein is used for a resonance operation of the capacitive component and the resonance reactor;

a dead time during which both the first main switch and the second main switch are maintained off at the same time is provided,

at the same time, at least during the period from turning-off of the second main switch to turning-on of the first main switch, the auxiliary switch is maintained on;

in the period during which the second main switch is on, the auxiliary switch is turned on and at the same time, in the period during which the first main switch is on, the auxiliary switch is turned off,

if the direction, in which a current flows through the second main switch when only the second main switch is on, is assumed to be the positive direction, the second main switch is turned off when the current flowing through the second main switch falls to zero or becomes negative in the period during which both the second main switch and the auxiliary switch are maintained on at the same time;

~~wherein~~ a smoothing reactor current measuring means for measuring a current iL which flows through the smoothing reactor is comprised, and

~~wherein~~ the second main switch is turned off is a period of time T1, during which both the second main switch and the auxiliary switch are maintained on at the same time, meets the condition of the following Expression 1

$$T1>Lr/V2[iL+\{(C1+C2)/Lr(V1^2 - V2^2)\}^{1/2}] \text{ ... Expression 1}$$

where V1 is a voltage to be applied to the smoothing reactor when the first main switch is turned on, V2 is a voltage to be applied to the smoothing reactor when the second main switch is turned on, Lr is the inductance of the resonance reactor, C1 is the

electrostatic capacitance of the capacitive component in parallel to the first main switch, and C2 is the electrostatic capacitance of the capacitive component in parallel to the second main switch.

7. (currently amended) ~~A DC/DC converter, as set forth in claim 4~~ A DC/DC converter comprising:

two main switches connected in series; and

a smoothing reactor one end of which is connected to the junction of the main switches; wherein

the two main switches are alternately turned on/off and at the same time, when a first main switch, which is one of the two main switches, is turned on, the electrical energy from a direct current power supply connected to the terminal on the input side is stored in the smoothing reactor, and when a second main switch, which is the other of the two main switches, is turned on, the electrical energy stored in the smoothing reactor is discharged to a load connected to the terminal on the output side;

an auxiliary resonance circuit, in which a resonance reactor and an auxiliary switch are connected in series, is comprised and at the same time a capacitive component is comprised in parallel to at least one of the two main switches,

when the auxiliary switch is on, the electrical energy is supplied from the terminal on the output side to the resonance reactor and the electrical energy stored therein is used for a resonance operation of the capacitive component and the resonance reactor;

a dead time during which both the first main switch and the second main switch are maintained off at the same time is provided,

at the same time, at least during the period from turning-off of the second main switch to turning-on of the first main switch, the auxiliary switch is maintained on;

in the period during which the second main switch is on, the auxiliary switch is turned on and at the same time, in the period during which the first main switch is on, the auxiliary switch is turned off,

if the direction, in which a current flows through the second main switch when only the second main switch is on, is assumed to be the positive direction, the second main switch is turned off when the current flowing through the second main switch falls to zero or becomes negative in the period during which both the second main switch and the auxiliary switch are maintained on at the same time;

~~wherein~~ a smoothing reactor current measuring means for measuring a current iL which flows through the smoothing reactor and a resonance reactor current measuring means for measuring a current ir which flows through the resonance reactor are comprised, and

~~wherein~~ the second main switch is turned off if, in the period during which both the second main switch and the auxiliary switch are maintained on at the same time, the current ir meets the condition of the following Expression 2

$$ir>iL+\{(C1+C2)/Lr\ (V1^2 - V2^2)\}^{1/2} \ldots \text{ Expression 2}$$

where V1 is a voltage to be applied to the smoothing reactor when the first main switch is turned on, V2 is a voltage to be applied to the smoothing reactor when the second main switch is turned on, Lr is the inductance of the resonance reactor, C1 is the

electrostatic capacitance of the capacitive component in parallel to the first main switch, and C2 is the electrostatic capacitance of the capacitive component in parallel to the second main switch.

8. (currently amended) A DC/DC converter, as set forth in claim [[1]] 6,

wherein the DC/DC converter is a step-down type, in which the output voltage is equal to or smaller than half the input voltage.

9. (currently amended) A DC/DC converter, as set forth in claim [[1]] 6,

wherein the DC/DC converter is a step-up type, in which the output voltage is equal to or smaller than two times the input voltage.

10. (currently amended) A DC/DC converter, as set forth in claim [[1]] 6,

wherein the DC/DC converter is a type, in which the absolute value of the output voltage is equal to or smaller than the absolute value of the input voltage.

11. (currently amended) A DC/DC converter, as set forth in claim [[1]] 6,

wherein the DC/DC converter is a step-down type, in which the output voltage is smaller than the input voltage, and

wherein an input filter capacitor is connected between the plus terminal on the input side of the DC/DC converter and the plus terminal of an output filter capacitor.

12. (currently amended) A DC/DC converter, as set forth in claim [[1]] 6,

wherein the DC/DC converter is a step-up type, in which the output voltage is larger than the input voltage, and

wherein an output filter capacitor is connected between the plus terminal on the output side of the DC/DC converter and the plus terminal of an input filter capacitor.

13. (currently amended) ~~A DC/DC converter, as set forth in claim 1~~ A DC/DC converter comprising:

two main switches connected in series; and

a smoothing reactor one end of which is connected to the junction of the main switches; wherein

the two main switches are alternately turned on/off and at the same time, when a first main switch, which is one of the two main switches, is turned on, the electrical energy from a direct current power supply connected to the terminal on the input side is stored in the smoothing reactor, and when a second main switch, which is the other of the two main switches, is turned on, the electrical energy stored in the smoothing reactor is discharged to a load connected to the terminal on the output side;

an auxiliary resonance circuit, in which a resonance reactor and an auxiliary switch are connected in series, is comprised and at the same time a capacitive component is comprised in parallel to at least one of the two main switches,

when the auxiliary switch is on, the electrical energy is supplied from the terminal on the output side to the resonance reactor and the electrical energy stored

therein is used for a resonance operation of the capacitive component and the resonance reactor;

~~wherein~~ the auxiliary switch is a bidirectional switch capable of allowing a current to flow bidirectionally, and

~~wherein~~ the DC/DC converter is a bidirectional type capable of reversing the input side and the output side by reversing the main switch to function as the first main switch and the main switch to function as the second main switch.

14. (currently amended) ~~A DC/DC converter, as set forth in claim 1,~~ A DC/DC converter comprising:

two main switches connected in series; and

a smoothing reactor one end of which is connected to the junction of the main switches; wherein

the two main switches are alternately turned on/off and at the same time, when a first main switch, which is one of the two main switches, is turned on, the electrical energy from a direct current power supply connected to the terminal on the input side is stored in the smoothing reactor, and when a second main switch, which is the other of the two main switches, is turned on, the electrical energy stored in the smoothing reactor is discharged to a load connected to the terminal on the output side;

an auxiliary resonance circuit, in which a resonance reactor and an auxiliary switch are connected in series, is comprised and at the same time a capacitive component is comprised in parallel to at least one of the two main switches,

when the auxiliary switch is on, the electrical energy is supplied from the terminal on the output side to the resonance reactor and the electrical energy stored therein is used for a resonance operation of the capacitive component and the resonance reactor;

~~wherein~~ the auxiliary switch is composed of two unidirectional switches capable of allowing currents to flow only in the directions opposite to each other, respectively and, at the same time, when one of the two unidirectional switches is turned on, a current flows only in one direction specified by the unidirectional switch turned on, and

~~wherein~~ the DC/DC converter is a bidirectional type capable of reversing the input side and the output side by reversing the main switch to function as the first main switch and the main switch to function as the second main switch and, at the same time, only one of the two unidirectional switches is operated according to the input/output direction.

15. (currently amended) ~~A DC/DC converter, as set forth in claim 1,~~ A DC/DC converter comprising:

two main switches connected in series; and

a smoothing reactor one end of which is connected to the junction of the main switches; wherein

the two main switches are alternately turned on/off and at the same time, when a first main switch, which is one of the two main switches, is turned on, the electrical energy from a direct current power supply connected to the terminal on the

input side is stored in the smoothing reactor, and when a second main switch, which is the other of the two main switches, is turned on, the electrical energy stored in the smoothing reactor is discharged to a load connected to the terminal on the output side;

an auxiliary resonance circuit, in which a resonance reactor and an auxiliary switch are connected in series, is comprised and at the same time a capacitive component is comprised in parallel to at least one of the two main switches,

when the auxiliary switch is on, the electrical energy is supplied from the terminal on the output side to the resonance reactor and the electrical energy stored therein is used for a resonance operation of the capacitive component and the resonance reactor;

~~wherein~~ the second main switch is turned on after the first main switch is turned on and a period of time T2 which meets the condition of the following Expression 3 elapses

$$T2 \geq (C1+C2)\ V1 + V2/iL \ \ldots \text{ Expression 3}$$

where V1 is a voltage to be applied to the smoothing reactor when the first main switch is turned on, V2 is a voltage to be applied to the smoothing reactor when the second main switch is turned on, iL is a current which flows through the smoothing reactor, C1 is the electrostatic capacitance of the capacitive component in parallel to the first main switch, and C2 is the electrostatic capacitance of the capacitive component in parallel to the second main switch.

16. (currently amended) A DC/DC converter, as set forth in claim [[1]] 6,

wherein a capacitive component in parallel to the auxiliary resonance circuit is provided instead of the capacitive component in parallel to the main switch.

17. (currently amended) A DC/DC converter, as set forth in claim [[1]] 6, wherein the second main switch is composed of only passive switches.

18. (new) A DC/DC converter, as set forth in claim 6, wherein

an output filter capacitor for suppressing variations in output voltage is connected to the terminal on the output side, and

when the auxiliary switch is on, the electrical energy to be supplied from the terminal on the output side to the resonance reactor is supplied from the output filter capacitor.

19. (new) A DC/DC converter, as set forth in claim 6, wherein

if the direction, in which a current flows through the first main switch when only the first main switch is on, is assumed to be the positive direction, the first main switch is turned on when the current flowing through the first main switch becomes negative or falls to zero.

20. (new) A DC/DC converter, as set forth in claim 19, wherein

an output filter capacitor for suppressing variations in output voltage is connected to the terminal on the output side, and

when the auxiliary switch is on, the electrical energy to be supplied from the terminal on the output side to the resonance reactor is supplied from the output filter capacitor.

21. (new) A DC/DC converter, as set forth in claim 7, wherein

if the direction, in which a current flows through the first main switch when only the first main switch is on, is assumed to be the positive direction, the first main switch is turned on when the current flowing through the first main switch becomes negative or falls to zero.

22. (new) A DC/DC converter, as set forth in claim 21, wherein

an output filter capacitor for suppressing variations in output voltage is connected to the terminal on the output side, and

when the auxiliary switch is on, the electrical energy to be supplied from the terminal on the output side to the resonance reactor is supplied from the output filter capacitor.

23. (new) A DC/DC converter, as set forth in claim 13, wherein

an output filter capacitor for suppressing variations in output voltage is connected to the terminal on the output side, and

when the auxiliary switch is on, the electrical energy to be supplied from the terminal on the output side to the resonance reactor is supplied from the output filter capacitor.

24. (new) A DC/DC converter, as set forth in claim 14, wherein

an output filter capacitor for suppressing variations in output voltage is connected to the terminal on the output side, and

when the auxiliary switch is on, the electrical energy to be supplied from the terminal on the output side to the resonance reactor is supplied from the output filter capacitor.

25. (new) A DC/DC converter, as set forth in claim 15, wherein

an output filter capacitor for suppressing variations in output voltage is connected to the terminal on the output side, and

when the auxiliary switch is on, the electrical energy to be supplied from the terminal on the output side to the resonance reactor is supplied from the output filter capacitor.